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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/544,783	08/08/2005	Koichi Terashima	Q89627	5339

22373 7590 12/23/2008
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EXAMINER	
SENT, PAPE A	

ART UNIT	PAPER NUMBER
2812	

MAIL DATE	DELIVERY MODE
12/23/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/544,783	TERASHIMA ET AL.	
	Examiner	Art Unit	
	PAPE SENE	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *08 August 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-65* is/are pending in the application.

4a) Of the above claim(s) *2,7,13-57 and 60-65* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-6,8-12,58 and 59* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 August 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *08/08/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims **1, 3, 5, 9-12 and 58-59** are rejected under 35 U.S.C. 102(b) as being unpatentable over Natan (Non-Patent Literature: "Anomalous first-phase formation in rapidly thermal annealed, thin layered Si/Ni/Si films").

1. Referring to claim **1**, Natan discloses a nickel silicide film formation method, comprising steps of: a step for forming a layer structure containing silicon and nickel on a substrate (Abstract) at a first substrate temperature which does not cause a silicide reaction (Pg. 257, Col. 2, Ln. 1-9, wherein the first temperature is room temperature); and a step of the silicide reaction for forming nickel monosilicide by implementing a thermal treatment of the layer structure (Pg. 257, Col. 2, Ln. 1-9, wherein the layer structure is the co-deposited Nickel and Silicon layers) at a second substrate temperature (Pg. 258, Col. 1, Ln. 40-45, wherein second substrate temperature is 300 ^{o}C or 573 K) which causes a nickel monosilicide reaction (Pg. 258, Col. 1, Ln. 40-45, wherein second substrate temperature is 300 ^{o}C or 573 K), wherein, in the step for forming the layer structure, a ratio (N_{Ni}/N_{Si}) of a number of total nickel atoms (N_{Ni}) to a number of total silicon atoms (N_{Si}) existing in a whole layer structure is equal to or more than 1 (Pg. 257, Col. 2, Ln. 1-9, wherein 100 over the Ni atomic percent is the ratio of number of total nickel atoms to a number of total silicon atoms; 2, 1.51, 1.26) and the layer structure formed with the step of forming the layer structure is an amorphous state (Abstract).

3. Referring to claim **3**, Natan discloses a nickel silicide film formation method as in claim 1, wherein the step for forming the layer structure consists of alternately forming at least two nickel layers and at least two silicon layers (Pg. 257, Col. 2, Ln.1-9, wherein a layer of Si is formed, then a layer of Ni).

5. Referring to claim **5**, Natan discloses a nickel silicide film formation method as in claim 1, wherein the ratio (N_{Ni}/N_{Si}) of the number of total nickel atoms (N_{Ni}) to the number of total silicon atoms (N_{Si}) existing in the whole layer structure is equal to or more than 1, and equal to or less than 4 (Pg. 257, Col. 2, Ln. 1-9, wherein 100 over the Ni atomic percent is the ratio of number of total nickel atoms to a number of total silicon atoms; 2, 1.51, 1.26).

10. Referring to claim **10**, Natan discloses a nickel silicide film formation method as in claim 3, wherein each thickness of the silicon layer and the nickel layer (Pg. 257, Col. 2, Ln. 1-9, wherein 66 and 100 Angstroms are 6.6 and 10 nanometers) formed with the step of forming the layer structure is in a range of 2 nm-10 nm: 6.6nm or 10 nm.

12. Referring to claim **12**, Natan discloses a nickel silicide film formation method as in claim 1, further comprising a step for implementing a preliminary thermal treatment at a low temperature (Room temperature, Pg. 257, Col. 2, Ln. 1-9) lower than the second substrate temperature (300 ^{o}C or 573 K, Pg. 258, Col. 1, Ln. 40-45) after the step of forming the layer structure and before the step of the silicide reaction (Pg. 258, Col. 1, Ln. 40-45).

58. Referring to claim **58**, Natan discloses a nickel silicide formation method, comprising steps of: a step for forming a stacked layer film by alternately forming at least one nickel layer and at least one silicon layer (Pg. 257, Col. 2, Ln.1-9, wherein a layer of Si is formed, then a layer of Ni) on a substrate at a first substrate temperature which does not cause a silicide reaction (Pg. 257, Col. 2, Ln. 1-9, wherein the first temperature is room temperature); and a step of the silicide reaction for forming a nickel silicide film by implementing a thermal treatment of the stacked layer film at a second substrate temperature which causes a nickel monosilicide reaction (Pg. 258, Col. 1, Ln. 40-45, wherein second substrate temperature is 300 ^{o}C), wherein, in the step for forming the stacked layer film a ratio of a total silicon layer thickness to a total nickel layer thickness in the stacked layer film is equal to or less than 1.79 (Pg. 257, Col. 2, Ln. 1-9, wherein 100 over the Ni atomic percent is the ratio of number of total nickel atoms to a number of total silicon atoms; 2, 1.51, 1.26, wherein the thickness ratio is less than 1.79 when the atomic ratio is greater than or equal to one) and the stacked layer film formed with the step for forming the stacked layer film is an amorphous state (Abstract).

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims **4, 8 and 11** are rejected under 35 U.S.C. 103(a) as being unpatentable over Natan (Non-Patent Literature: "Anomalous first-phase formation in rapidly thermal annealed, thin layered Si/Ni/Si films") in view of Bokhonov (Non-Patent Literature : "In-situ investigation of the formation of nickel silicides during interaction of single-crystalline and amorphous silicon with nickel).

4. Referring to claim **4**, Natan discloses a nickel silicide film formation method as in claim 3, but does not disclose that that the layer structure is formed such that a ratio of the number of nickel atoms in each nickel layer contained in the layer structure to the number of silicon atoms in each silicon layer contained in the layer structure is equal to a ratio of the number of total nickel atoms to the number of total silicon atoms existing in a whole layer structure.

Bokhonov teaches that the layer structure is formed such that a ratio of the number of nickel atoms in each nickel layer contained in the layer structure to the number of silicon atoms in each silicon layer contained in the layer structure is equal to a ratio of the number of total nickel atoms to the number of total silicon atoms existing in a whole layer structure (Pg. 188, Col. 2, Ln. 7-15).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the disclosure of Natan, to further comprise the teaching of Bokhonov, and further disclose a nickel silicide formation method, for the purpose of insignificantly increasing the thickness of the amorphous silicide during isothermal annealing (Bokhonov, Pg. 188, Col. 2, Ln. 7-15 and Pg. 187, Col. 1, Ln. 10-15).

8. Referring to claim **8**, Natan discloses a nickel silicide film formation method as in claim 1, but does not disclose that the substrate is any one selected from a group of a silicon substrate, a SOI substrate, and a SGOI substrate.

Bokhonov teaches that the substrate is any one selected from a group of a silicon substrate, a SOI substrate, and a SGOI substrate: Silicon substrate (Pg. 187, Col. 2, Ln.14 – Pg. 188, Col. 1, Ln. 5, wherein the silicon substrate is amorphous).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the disclosure of Natan, to further comprise the teaching

of Bokhonov, and further disclose a nickel silicide formation method, for the purpose of increasing the growth rate of the silicide phase (Bokhonov Pg. 187, Col. 2, Ln.14 – Pg. 188, Col. 1, Ln. 5).

11. Referring to claim **11**, Natan and Bokhonov disclose a nickel silicide film formation method as in claim 1, but does not disclose that a surface orientation of a principal surface of the substrate is other than (111) surface.

Bokhonov teaches that a surface orientation of a principal surface of the substrate is other than (111) surface (Pg. 187, Col. 2, Ln.14 – Pg. 188, Col. 1, Ln. 5, wherein the amorphous substrate surface is not 111, for a faster growth rate of NiSi).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the disclosure of Natan, to further comprise the teaching of Bokhonov, and further disclose a nickel silicide formation method, for the purpose of increasing the growth rate of the silicide phase (Bokhonov Pg. 187, Col. 2, Ln.14 – Pg. 188, Col. 1, Ln. 5).

Claim **6** is rejected under 35 U.S.C. 103(a) as being unpatentable over Natan (Non-Patent Literature: "Anomalous first-phase formation in rapidly thermal annealed, thin layered Si/Ni/Si films") in view of Mangelinck (Non-Patent Literature: " Formation of Ni silicide from Ni(Au) films on (111)Si").

Natan discloses a nickel silicide film formation method as in claim 1, wherein the nickel silicide contains nickel monosilicide (Pg. 258, Col. 1, Ln. 40-45) but does not specifically disclose that the nickel silicide contains the nickel monosilicide equal to or more than 50%.

Mangelinck teaches a nickel silicide film formation method as in claim 1, wherein the nickel silicide contains the nickel monosilicide equal to or more than 50% (Pg. 4079, Col. 2, Ln. 4-10).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the disclosure of Natan to further comprise the teaching of Mangelick for the purpose of growing nickel monosilicide (NiSi) at the expense of both Ni_2Si and Ni (Mangelick, Pg. 4078, Abstract).

Response to Arguments

Applicant's arguments filed on August 29th, 2008 have been fully considered but they are not persuasive.

Applicants argue that Natan only discloses an amorphous state only in reference to the silicon (Si) layer, but that the present claims require the layer structure, including the nickel (Ni) and the Si layers, to be formed in an amorphous state.

In the applicants' disclosure, an amorphous state is defined as the situation wherein a nickel layer is formed on an amorphous silicon layer as provided in [0021]-[0022] to obtain nickel monosilicide.

Natan discloses in its abstract as well that the mixture of (Ni +Si) was at an amorphous state prior to the forming of nickel monosilicide, therefore the nickel and silicon layers are formed in an amorphous state

Conclusion

1. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to PAPE SENE whose telephone number is (571)270-5284. The examiner can normally be reached on 5/4/9.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Garber can be reached on (571)272-2194. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/PAPE SENE/
Examiner, Art Unit 2812

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